Evaluation of peripheral dose for SRS treatment radiations with the VIS CyberKnife: A phantom study.

Methods: Eight patients treated using the CyberKnife were selected for this study. Organs at risk and target were delineated on volumetric CT data and treatment planning (Multiplan v.4.5.0) was optimized accordingly, in order to achieve the required prescribed target dose and critical structures sparing for each patient. The final treatment plan, consisted from a set of non-isocentric and non-coplanar beams was delivered with a CyberKnife VIS (Accuray, Inc., Sunnyvale, CA) operating with a dose rate of 1000 MU/min at a flattening filter free mode and upgraded shielding. We performed our measurements using a male anthropomorphic RANDO phantom (Alderson Research Laboratories, Inc., Stamford, CT). Groups of three TLD 100 were placed anteriorly inside RANDO at a depth of 5 cm at locations corresponding to the thyroid, breast or lung, uterus and inferior abdomen for each treatment plan. The TLDs were read using a Harshaw QS 5500 TLD reader. Lastly calibration of TLDs was done with 10cGy delivered at 80cm SAD and 1.5cm depth.

Results: Fig. 1 (a) illustrates the peripheral dose (PD) as a function of the delivered MUs for eight patients. The max appears at $2.5 \times 10^{-3} \text{cGy/MU}$ for the tumor located in the right anterior intracranial region. Fig. 1 (b) shows the %PD normalized to the prescribed dose. It is clear that the higher dose received from the thyroid gland region as it was expected due to its proximity to the treated target. A more profound correlation is observed of the %PD as a function of the prescribed dose. This correlation might be considered in the treatment planning and delivery of the dose.

Discussion: Our preliminary results indicate a relationship between the PD and the prescribed dose. Analysis of previously collected data of patients undergoing radiotherapy of intracranial lesions and comparison with our current data with the CyberKnife will indicate the benefit of the upgraded shielding and the higher dose rate of the VIS vs the G4 model.

![Fig.1. PD as a function of the delivered MUs (a) and the Prescribed dose (b) for eight patients.](image)